



COMBINED EFFECT OF THE COMPONENTS OF CRITICAL PROBLEM SOLVING SKILLS ON ACHIEVEMENT

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ABSTRACT

Critical Problem Solving Skill was once thought to be the domain of the gifted learners. But today it is the need of every individual learner who desires to make sensible decisions about everything that matters to them. Present education should prepare the learners for life. Hence, they are crucial skills to be taught in the classroom. It makes them rational thinkers involving critiques. The National Curriculum Framework 2005 recommends a paradigm shift from rote memory to learning by understanding. It suggests that schools should facilitate construction of knowledge, in order to become independent thinkers capable of solving problems both in the classroom as well in the world. An important goal of education is to enable students to think more productively while solving problems by combining critical thinking, problem solving and creative thinking. An integrative approach of these skills will prove an effective instruction method. It facilitates learners to approach the real-world scenarios and problems with open-mindedness and with self-confidence. This experimental study aimed at to study the combined effect of the components of the Critical Problem Solving Skills on achievement in Political Science among students of Higher Secondary School. 70 students comprised the sample of this study and the results revealed that there exists a significant combined effect of components of Critical Problem Solving Skills on the achievement in Political Science.

KEY WORDS: Critical Problem Solving Skills, Achievement, Political Science, Critical thinking, Decision making.

INTRODUCTION:

Critical Problem Solving is one of the effective strategies taught in the schools. But are the students solving problems or engaged in mere exercises? The former stresses critical thinking and decision making, and the latter concentrates only on the application of previously learnt procedures. The goal of education is to help and teach how to think more productively while solving problems, by combining creative thinking to generate ideas and critical thinking to evaluate ideas. It enables students with opportunities to use their newly acquired knowledge in meaningful, real-life activities and assists them in working at higher levels of thinking. Scope for Critical Problem solving should be included in the curriculum (Carson, 2007).

Richard Paul (2013), a prominent advocate of Critical thinking and problem solving says, 'alternative solutions are often not given, they must be generated or thought-up. Critical thinkers must be creative thinkers and good problem solvers as well, generating possible solutions in order to find the best one. Very often a problem persists not because we can't tell which available solution is best, but because the best solution has not yet been made available – no one has thought of it yet'.

Critical problem solvers can work independently from higher supervision (Carson, 2007). They will take initiative, enjoy taking risks and will not be afraid to commit mistakes. They attempt to learn from their mistakes and habitually debrief their process to create more efficient and economical solutions. Critical problem solvers view data from multiple angles, in many dimensions. They are skilled at conceptualization, organisation, classification and knowledge synthesis. These skills are instrumental to deal practically with problems of a social, mathematical and scientific nature. It empowers them to make effective and level-headed decisions in their lives. It is essential even beyond school. Problem solving comes naturally to the students, but it should be enhanced profoundly with proper engagement in their learning.

Richard Paul and Linda Elder (2013), Critical Thinking giants, argue that Critical Problem Solving requires a highest level of Problem Solving skills. They discuss about Critical Problem Solving Skills in their book. But the researcher has modified the skills according to the need of the study. They are outlined as below:

A. Problem Identification:

The learner needs to gain a clear understanding of the problem or situation. After identifying the problem one should state the problem clearly and concisely. Identifying the problem also means describing as precisely as possible the existing gaps between one's perception of present circumstances and what one would like to happen (Ching-Chih Kuo 2010). In this step, the individual masters the skill of problem recognition. In the process of identification of problem there appears three types of gaps-something is wrong and needs to be corrected, something is threatening and needs to be prevented, something is inviting and needs to be accepted and something is missing and needs to be provided.

B. Analysis of the Problem:

Here one looks at the problem from a variety of perspectives and in different

angles. Explanation, gathering information and analysis of the problem occupies important place. Participants share possible solutions, then they classify, categorise and prioritize problems, arrange them hierarchically from most important to least important. Learners must state the criteria which will be used for evaluation of possible alternatives, to the problem as well as the effectiveness of chosen probable solutions. Deductive and inductive approach could be applied to reason out and generate criteria. Important criteria is placed into different categories and selection is made. These selected criteria are then evaluated in terms of their reasonableness given in the problem statement. These criteria can be modified based on important facts identified in the next phase (Carson, 2007).

C. Structuring Arguments:

Here information and facts relevant to solving problem are gathered. This step is critical for understanding the initial conditions and for further clarification of the perceived gap. Quality of facts and information is more important than the quantity. Learner structures systematically the arguments which have been gathered from various sources. The relevant facts are analysed in terms of problem statement and non-pertinent facts are eliminated and remaining facts and information are then prioritized, and additional facts are collected. It also involves gaining a deeper understanding of the problem. In this process, the critical thinker infers, hypothesises, predicts and tests hypotheses.

D. Decision Making:

The fourth step consists of deriving possible solutions. Critical thinkers weigh the evidence and arguments that they have gathered. Supporting data, logic and evidence increase the weight of an argument. Data is carefully analysed, and different possible solutions are tried and then the best one is chosen for implementation.

Considerable amount of time should be spent on this phase to ensure creative alternative to generate. After which, categorise and classify alternatives. Next, the learner should evaluate advantages, disadvantages and interesting facts of the alternatives is discussed in the group. Written evaluation seems to be a good practice. Group after the discussion discards the alternatives which are outside the bounds of the problem. Only those alternatives of importance are retained and considered to solve the problem. This is the most complex part of the problem solving process since one needs to look at each potential solution and carefully analyse it. The critical thinker masters at this step the skill of evaluation, synthesizing and problem solving.

Evaluating the implementation of solution is very important. It should be an ongoing process and the evaluating the effectiveness of the solution is particularly very important in the light of the problem statement generated at the beginning of the process. Cognitive, affective and psychomotor behavioural outcomes should be considered. The solution should be judged as to its efficiency, its impact on the people involved and the extent to which it is valued by the participants. It is generally accepted that three elements are essential – a knowledge base, an adequate level of thinking and

communication skill and an organised approach or strategy to solve problems.

José van Hanegem (2017), research study revealed that the problem-solving skills of students significantly improved, and the awareness of students' own problem-solving process and skills increased. Ramazan Cansoy (2017) proved that the critical thinking disposition and problem-solving skills revealed significant positive correlations. Ozcan Ozyurt's (2015) study indicated that the students had high-level critical thinking dispositions and problem solving skills.

Kyung-Sook Kim and Jung-Hyun Choi (2014) study demonstrated the fundamental importance of professional self-concept and critical thinking disposition to improve problem solving ability. Shelly Wismath et al, (2014) study concluded that pupils had increased awareness of problem solving skills. The above mentioned studies prove the findings of the present study. Hence it is concluded that there is combined effect of the components of the Critical Problem Solving Skills on achievement in Political Science among pupils of Higher Secondary School.

In addition to it, the investigator also questions the existing education system, which provides less scope for learners to be independent thinkers and problem solvers. But the present students are not taught to solve these problems by applying their higher order intellectual skills. Present education should prepare the learners for life. Hence, they are crucial skills to be taught in the classroom. It makes them rational thinkers involving critiques. Therefore, the investigator undertook this study to study the combined effect of Critical Problem Solving Skills on Higher Secondary students.

OBJECTIVE:

To study the combined effect of the components of Critical Problem Solving Skills on achievement in Political Science among students of Higher Secondary School.

MATERIALS AND METHODS:

Operational Definition:

Critical Problem Solving Skills: In the present study, Critical Problem Solving Skill means the intentional application of rational, higher order thinking skills, such as analysis, synthesis, problem recognition and problem solving, inference, and evaluation in a classroom situation. It has four components. They are as follows: Problem Identification, Analysis of Problem, Structuring Arguments, Decision Making. Scores obtained from a test on Critical Problem Solving Skills is considered in the study.

Academic Achievement: In the present study, achievement in Political Science is the scores obtained by the students in the Achievement Test constructed by the researcher.

In the present study, the population consists of all the students of Arts stream in general and Political Science in particular of Higher Secondary students of English medium schools of Dakshina Kannada District. Seventy students of Higher Secondary School of class XI, studying under Karnataka Higher Secondary Board, studying during the academic year 2017-2018 comprised the samples of the study.

A test on Critical Problem Solving Skills and an Achievement Test on Political Science was constructed and validated by the investigator. The researcher employed following statistical techniques in order to analyse data, they are, Descriptive statistics – Mean, SD and Inferential statistics – ANCOVA and Multiple regression.

RESULTS AND DISCUSSION:

Objective of the study was to find out the combined effect of the components of the Critical Problem Solving Skills on achievement in Political Science among students of Higher Secondary School and scores of components of Critical Problem Solving Skills were subjected to multiple regression analysis using ANCOVA approach.

Hypothesis H₀: Joint and individual contribution of the components of Critical Problem Solving Skills has no significant effect on the achievement in Political Science.

Table showing results of Regression Analysis of combined effect of the components of the Critical Problem Solving Skills on achievement in Political Science.

R	R ²	% of Variance	Adjusted R Square	Std. Error of the Estimate
0.667 ^a	0.445	44.5%	0.362	8.27427

ANOVA ^a					
Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	1479.360	4	369.840	5.402	0.003 ^b
Residual	1848.515	27	68.464		
Total	3327.875	31			
Coefficients					
	Unstandardized Coefficients	Standardized Coefficients		t	Sig.
	β	Std. Error	Beta		
(Constant)	9.090	4.484		2.027	0.053
Prob. Identification	2.605	1.652	0.239	1.577	0.127
Analysis of Problem	2.413	1.361	0.295	1.773	0.087
Structuring Arguments	0.578	1.529	0.070	0.378	0.709
Decision Making	2.272	1.339	0.340	1.696	0.101

Result of regression analysis given in the table reveals that the index of predictability is 0.667 and the percentage variance accounted by the variables Problem Identification (X₁), Analysis of the Problem (X₂), Structuring Arguments (X₃) and Decision Making (X₄), in predicting combined effect on the academic achievement is 44.5%.

The obtained 'F' value 5.40 with 4 and 27 degrees of freedom is greater than the table value 3.04 at 0.01 level of significance. This suggests that the predictor variables are significant in predicting achievement in Political Science.

The β coefficient of the variables Problem Identification (X₁), Analysis of the problem (X₂), Structuring Arguments (X₃) and Decision Making (X₄), are 2.60, 2.41, 0.578 and 2.72 respectively. So, the multiple regression equation for predicting the achievement of student by means of predictor variables X₁, X₂, X₃, and X₄ is written as,

$$Y = 2.60 X_1 + 2.41 X_2 + 0.578 X_3 + 2.72 X_4 + 9.09$$

This equation suggests that for unit increase in X₁, Y increases by 2.60 units when the effect of X₂, X₃ and X₄ are held constant. For unit increase in X₂, Y increases by 2.41 units when the effect of X₁, X₃ and X₄ are held constant. For unit increase in X₃, Y increases by 0.578 units when the effect of X₁, X₂ and X₄ are held constant. For unit increase in X₄, Y increases by 2.72 units when the effect of X₁, X₂ and X₃ are held constant. From the regression equation Decision Making (X₄) is the best predictor of Critical Problem Solving Skills compared with other skills of Critical Problem Solving.

So, it can be generalized that there exists a significant combined effect of components of Critical Problem Solving Skills on the achievement in Political Science.

It may be inferred that addition and improvement in each of the components of above predictor variables will result in improvement in Critical Problem Solving Skills.

A number of factors are responsible for enhancing Critical Problem Solving Skills. In the present study an attempt was made to find out the predictor variables of Critical Problem Skills. Predictor variables considered in the present study were studied independently by the researcher. Findings of José van Hanegem (2017), Ramazan Cansoy (2017), Ozcan Ozyurt's (2015), Kyung-Sook Kim and Jung-Hyun Choi (2014), Shelly Wismath et al, (2014) support the results of the present study.

EDUCATIONAL IMPLICATIONS:

- Existing school curriculum need to be modified by structuring the syllabus in the form of a problem. This will enable students of all levels to master the art of Critical Problem Solving Skills. Hence this type of restructuring of syllabus should not be restricted to mathematics and Science alone but also to be extended to Social Sciences as well.
- Learners should be helped to focus on the solution, simplifying the problem, defining the problem clearly and selecting the most appropriate solution. Here role of the teacher is very crucial as students with different levels of intelligence face the problem in varied manner. Teacher should focus on developing the skills of Critical Problem Solving.
- Teacher should plan additional research projects (in small scale) for those stu-

dents who possess higher level of intelligence and are competent enough to solve complex problems in secondary and higher secondary schools. This will accelerate learning and refine their existing problem solving skills.

CONCLUSION:

The present study has asserted that it is essential to teach learners Critical Problem Solving Skills and incorporate it in school curriculum. The investigator conducted an experimental research to study the combined effect of the components of the Critical Problem Solving Skills on achievement in Political Science among students of Higher Secondary School. A test on Critical Problem Solving Skills and Achievement test in Political Science was constructed and validated by the experts, to measure the scores on the same. Study revealed that there exists a significant combined effect of components of Critical Problem Solving Skills on the achievement in Political Science.

Hence, the researcher suggests learners need to develop and effectively apply critical problem solving skills to their academic studies, to the complex problems that they will face and the critical choices they will be forced to make in the future.

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